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Exceptional records of *Microgale* species (Insectivora: Tenrecidae) in vertebrate food remains

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Abstract. Records of *Microgale* species identified from scats and pellet remains of predators are reviewed. Cranial fragments of at least two individuals of *Microgale melanorrhachis* and a humerus of *M. talazaci* were identified from faeces of *Cryptoprocta ferox* collected at Montagne d'Ambre in northern Madagascar. Remains of *M. pusilla* were identified from *Tyto alba* pellets collected on the human-modified Central High Plateau near Antananarivo. The records of *M. pusilla* suggest that this species is not particularly sensitive to environmental disturbance.

Key words. *Microgale* spp., shrew tenrecs, prey remains, *Cryptoprocta ferox*, *Tyto alba*.

Introduction

Except for the study of Eisenberg & Gould (1970), conducted in the eastern rainforest of Madagascar, remarkably little has been published on the natural history and ecology of the shrew tenrecs (Family Tenrecidae, Subfamily Oryzorictinae) [sensu Hutterer (1993)]. In his recent revision of the genus *Microgale*, MacPhee (1987) summarized information on the distribution and habitat requirements of this genus based on museum specimens. Further, he identified remains of *Microgale* species from owl pellets, and in several cases these records represented exceptional range extensions and expanded our knowledge of shrew tenrec habitat requirements.

In general, using standard trapping techniques *Microgale* species are relatively difficult for mammalogists to capture. The presence of *Microgale* remains in predators' food remains allow insight into the distribution of shrew tenrecs. In this paper we present some information on *Microgale* species found in the pellets of owls and the scats of carnivores, and discuss the implications of these data on the distribution and habitat specificity of shrew tenrecs.

Results and discussion

Scats of *Cryptoprocta ferox* Bennett, 1833. — On 15 April 1992, Dr. Chris Raxworthy collected four scats in the Montagne d'Ambre National Park (12°28'S, 49°11'E), 40 km S Antsiranana. The average annual rainfall in the park is approximately 3600 mm (Nicoll & Langrand 1989). The scats were found at 900 m, next to Petit Lac (also known as Matsabory Mahasarika), a crater lake that lies in the heart of the forest, on a large flat rock within 20 m of the forest edge. This site is known to be frequented by *Cryptoprocta* and its scats are easily distinguished from other native and introduced carnivores (Rasolonandrasana 1994). On the basis of size and context, the scats were identified as those of *Cryptoprocta*. The vegetation surrounding the lake is composed of undisturbed rainforest, with an average canopy height of 30 m, and some emergent trees reaching 35 m. The understory is open and botanically diverse.

The leaf-litter is thick and permanently moist.

Inside the scats, cranial and post-cranial remains of at least two *Microgale melanorrhachis* Thomas, 1882. The mandibular rami in which m3 are present show the characteristic shape of the talonid or the toothrows with distinct diastemata, both of which diagnose this species. The distal end of a humerus was also recovered from the scats. On the basis of size, this bone was identified as *Microgale talazaci* Major, 1896a.

In a recent study of the small mammals of the Montagne d'Ambre National Park, Raxworthy & Nussbaum (1994) listed *M. melanorrhachis* Morrison-Scott, 1948 and *M. talazaci*, as well as several other species in this genus, as occurring within the local forest. *M. melanorrhachis* was found between 1125 and 1250 m and *talazaci* between 660 and 1250 m. MacPhee (1987) treats *M. melanorrhachis* as a synonym of *M. cowani*, however Nicoll & Rathbun (1990), Raxworthy & Nussbaum (1994), Stephenson (1995) and Jenkins et al. (1996) consider these taxa as distinct species.

Little is known about the food habits of *Cryptoprocta*. Albignac (1973) noted that in the wild this carnivore preys upon insectivores, particularly *Tenrec ecaudatus* (Schreber, 1777). The presence of the *M. melanorrhachis* remains in the scats, an animal weighing on average 12.7 g (range 10.5—15.0 g, n = 14), shows that this carnivore consumes small prey.

Barn Owl (*Tyto alba*) pellets. — Two separate collections of fresh barn owl pellets (n = 18) obtained on the Central High Plateau near the capital city of Antananarivo (1300 m; 18°55'S, 47°31'E) contained the bone remains of *Microgale pusilla* Major, 1896b; a shrew tenrec weighing on average 3.0 g (range 2.6—3.9, n = 12). The first collection, which consisted of a minimum of two *M. pusilla*, was obtained in February 1993 on the outskirts of Antananarivo in the district of Mahazoarivo (18°56'S, 47°33'E) below a roost. The local habitat is mostly human habitation surrounded by a patchwork of small rice paddies, dense eucalyptus and pine plantations, and open fields. A collection obtained from this site in January—February 1992 has already been reported on by Goodman & Langrand (1993), but did not contain *Microgale* remains.

A second barn owl pellet collection, including a minimum of three *M. pusilla*, was obtained in mid-July 1992 near Ilafy (18°51'S, 47°34'E), at 1350 m, 13 km NE of Antananarivo, in an area of anthropogenic savanna with rice paddies in valley bottoms and eucalyptus and pine plantations and a few houses on higher ground. The only local natural vegetation consists of a few *Dracaena* and *Ficus* trees. The savanna grassland is burnt once or twice a year for grazing purposes. All of these remains were identified as *M. pusilla* on the basis of size, the shape of the talonid of m3, and tooth socket structure.

Nothing is known about the hunting range of *Tyto alba* on Madagascar or for that matter on the African continent (Fry et al. 1988). In Europe it probably does the majority of hunting within the breeding territory, which varies from 0.4—2.5 km^2 depending on food availability (Cramp 1985). Thus, it is assumed that the prey found in the remains reported herein were taken in the immediate vicinity of the roost sites.

MacPhee (1987) noted that the majority of *M. pusilla* museum specimens came from the eastern rainforest, but there are several "anomalous" records of this animal elsewhere on the island. These include remains found in owl pellets collected along the Mahafaly Plateau (100—200 m), an area in southwestern Madagascar with sub-

arid thorn scrub and no permanent marshes (MacPhee 1986, 1987); at Antsiforakely (1600 m), a locality on the Central High Plateau with little remaining natural forest, but relatively extensive wetlands (MacPhee 1987); and near Antsirabe (1500 m), also on the Central High Plateau, surrounded by little natural habitat except for marshland (Major 1897). On the basis of this information, *M. pusilla* occurs in a wide variety of habitats, including non-forested areas and heavily modified agricultural zones. This same pattern has also been found for other shrew tenrecs, namely *M. cowani*, *M. dobsoni* Thomas, 1884, and *M. brevicaudata* Grandidier, 1899 (Kaudern 1918, MacPhee 1987).

In deforested zones of the Central High Plateau several *Microgale* species, which were previously thought to be forest dependent, persist in areas with extensive anthropogenic habitat modification. Presumably populations of these species remain in marshlands or small vestige patches of forests. Further, *M. cowani*, *M. dobsoni*, and *M. pusilla* are known from some of the remaining forests on the Central High Plateau, which are fragmented (Stephenson et al. 1994). These *Microgale* species cannot be used as "biological indicators" of undisturbed habitat. Other samples of barn owl pellets collected in heavily modified areas of the eastern rainforest and Central High Plateau have not yielded *Microgale* remains (Goodman & Langrand 1993, Goodman et al. 1993), and thus, there is either considerable seasonal or individual variation in the food habits of this owl, or remnant populations of *Microgale* species are exceptionally patchy in distribution.

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Zusammenfassung

Die Autoren berichten über Funde von Tenreciden der Gattung *Microgale* in Karnivorenkot und in Eulengewöllen. Schädelreste von mindestens zwei Individuen von *Microgale melanorrhachis* und ein Humerus von *M. talazaci* wurden in Kotproben von *Cryptoprocta ferox* identifiziert, die in Nord-Madagaskar in der Montagne d'Ambre gesammelt wurden. Reste von *M. pusilla* fanden sich in Gewöllen von *Tyto alba*, die auf einem degradierten zentralen Hochplateau nahe Antananarivo gesammelt wurden. Die Funde von *M. pusilla* deuten darauf hin, daß diese Art nicht besonders empfindlich auf Umweltveränderungen reagiert.

Résumé

La mention de deux espèces de *Microgale*, dont la présence a été mise en évidence par l'analyse des fèces ou des pelotes de rejection de prédateurs, fait l'objet d'une revue. Des fragments de crâne d'au moins deux individus de *Microgale melanorrhachis*, ainsi qu'un humérus de *Microgale talazaci* ont été identifiés à partir de fèces de *Cryptoprocta ferox* collectés à la Montagne d'Ambre, dans le nord de Madagascar. Des restes de *M. pusilla* ont été trouvés dans des pelotes de *Tyto alba* collectées dans un milieu fortement anthropique, localisé sur les Hauts Plateaux près d'Antananarivo. Ces dernières données suggèrent que *M. pusilla* n'est pas particulièrement sensible aux changements environnementaux.

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